

CLAIMS

What is claimed is:

1. A composition comprising, or produced from, titanium or a titanium compound, a phosphorus-containing ester, and optionally a solvent
5 wherein said titanium compound is a titanium chelate comprising or produced from a tetraalkyl titanate and a complexing agent; said complexing agent is a hydroxycarboxylic acid, an alkanolamine, an aminocarboxylic acid, or combinations of two or more thereof; and said phosphorus-containing ester contains no free P-OH group.
- 10 2. A composition according to claim 1 wherein said phosphorus-containing ester is a phosphite ester.
3. A composition according to claim 1 wherein said phosphorus-containing ester is tris-phosphite ester, diphosponite ester, or combinations thereof.
- 15 4. A composition according to claim 1 wherein said phosphorus-containing ester is trimethyl phosphite; triethyl phosphite; tributyl phosphite; triisopropylphosphite; trisdodecyl phosphite; trinonyldecyl phosphite; triphenylphosphite; phosphorous acid, [1,1'-biphenyl]-4,4'-diylbis-, tetrakis(2,4-bis(1,1-dimethylethyl)phenyl)ester; (tris-(2,4-di-t-butyl) phosphite; triethylene
20 glycol phosphite; tripropylene glycol phosphite; tributylene glycol phosphite; or combinations of two or more thereof.
5. A composition according to claim 2 wherein said complexing agent is an α -hydroxycarboxylic acid, an alkanolamine, an α -aminocarboxylic acid, or combinations of two or more thereof.
- 25 6. A composition according to claim 4 wherein said complexing agent is lactic acid, glycolic acid, citric acid, isocitric acid, tartaric acid, malic acid, malonic acid, glycine, hydroxyethyl glycine, bis-hydroxyethyl glycine, or combinations of two or more thereof.
7. A composition according to claim 4 wherein said complexing agent
30 is lactic acid.

8. A composition according to claim 4 wherein said tetraalkyl titanate is tetra isopropyl titanate, tetra n-butyl titanate, or combinations thereof.

9. A composition according to claim 7 wherein said tetraalkyl titanate is tetra isopropyl titanate, tetra n-butyl titanate, or combinations thereof.

5 10. A composition according to claim 1 wherein said composition further comprising a hypophosphorous acid, its salt, or both.

11. A composition according to claim 4 wherein said composition further comprising a hypophosphorous acid, its salt, or both.

10 12. A composition according to claim 7 wherein said composition further comprising a hypophosphorous acid, its salt, or both.

13. A composition according to claim 9 wherein said composition further comprising a hypophosphorous acid, its salt, or both.

14. A composition according to claim 9 wherein said composition further comprising sodium hypophosphite.

15 15. A composition according to claim 9 wherein said titanium compound is TYZOR[®]LA (titanium bis ammonium lactate).

16. A composition according to claim 3 further comprising a co-catalyst, which is aluminum, cobalt, zirconium, zinc, a compound comprising one or more of these metals, or combinations of two or more thereof.

20 17. A composition according to claim 8 further comprising a co-catalyst, which is zinc acetate, zinc chloride, zinc nitrate, zinc sulfate, or combinations of two or more thereof.

25 18. A composition according to claim 15 wherein said stabilizer is tributyl phosphite; phosphorous acid, [1,1'-biphenyl]-4,4'-diylbis-,tetrakis(2,4-bis(1,1-dimethylethyl)phenyl)ester; triethylene glycol phosphite; or combinations of two or more thereof.

30 19. A composition according to claim 17 wherein said stabilizer is tributyl phosphite; phosphorous acid, [1,1'-biphenyl]-4,4'-diylbis-,tetrakis(2,4-bis(1,1-dimethylethyl)phenyl)ester; triethylene glycol phosphite; or combinations of two or more thereof.

20. A process comprising contacting, in the presence of a catalyst composition, a carbonyl compound with an alcohol; wherein said composition comprises, or is produced from, a titanium compound, a phosphorus-containing ester, and optionally a solvent; said titanium compound is a titanium chelate
5 comprising or produced from a tetraalkyl titanate and a complexing agent; said complexing agent is a hydroxycarboxylic acid, an alkanolamine, an aminocarboxylic acid, or combinations of two or more thereof; and said phosphorus-containing ester a phosphite ester containing no free P-OH group.

21. A process according to claim 20 wherein said phosphorus-
10 containing ester is a tris-phosphite ester, diphosponite ester, or combinations.

22. A process according to claim 21 wherein said phosphorus-
containing ester is trimethyl phosphite; triethyl phosphite; tributyl phosphite; tri-
isopropylphosphite; trisdodecyl phosphite; trinonyldecyl phosphite;
triphenylphosphite; phosphorous acid, [1,1'-biphenyl]-4,4'-diylbis-, tetrakis(2,4-
15 bis(1,1-dimethylethyl)phenyl)ester; (tris-(2,4-di-t-butyl) phosphite; triethlyene glycol phosphite; tripropylene glycol phosphite; tributylene glycol phosphite; or combinations of two or more thereof.

23. A process according to claim 21 wherein said complexing agent is an α -hydroxycarboxylic acid, an alkanolamine, an α -aminocarboxylic acid, or
20 combinations of two or more thereof.

24. A process according to claim 22 wherein said complexing agent is lactic acid, glycolic acid, citric acid, isocitric acid, tartaric acid, malic acid, malonic acid, glycine, hydroxyethyl glycine, bis-hydroxyethyl glycine, or combinations of two or more thereof.

25. A process according to claim 22 wherein said complexing agent is lactic acid.

26. A process according to claim 22 wherein said tetraalkyl titanate is tetra isopropyl titanate, tetra n-butyl titanate, or combinations thereof.

27. A process according to claim 25 wherein said tetraalkyl titanate is
30 tetra isopropyl titanate, tetra n-butyl titanate, or combinations thereof.

28. A process according to claim 22 wherein said composition further comprising a hypophosphorous acid, its salt, or both.

29. A process according to claim 27 wherein said composition further comprising a hypophosphorous acid, its salt, or both.

30. A process according to claim 28 wherein said composition further comprising sodium hypophosphite.

5 31. A process according to claim 27 wherein said carbonyl compound is terephthalic acid or ester thereof and said alcohol is ethylene glycol.

32. A process according to claim 27 wherein said titanium compound is TYZOR®LA (titanium bis ammonium lactate).

10 33. A process according to claim 26 further comprising a co-catalyst, which is aluminum, cobalt, zirconium, zinc, a compound comprising one or more of these metals, or combinations of two or more thereof.

34. A process according to claim 32 further comprising a co-catalyst, which is zinc acetate, zinc chloride, zinc nitrate, zinc sulfate, or combinations of two or more thereof.

15 35. A process comprising contacting a carbonyl compound, optionally in the presence of a catalyst, with an alcohol to produce a product comprising an oligomer and contacting said product with a phosphorus-containing ester; said carbonyl compound is an organic acid or its salt or its ester or combinations thereof; and said phosphorus-containing ester a phosphite ester containing no free
20 P-OH group.

36. A process according to claim 35 wherein said phosphorus-containing ester is a tris-phosphite ester, diphosphonite ester, or combinations.

25 37. A process according to claim 36 wherein said catalyst comprises, or is produced from, a titanium compound, and optionally a solvent; said titanium compound is a titanium chelate comprising or produced from a tetraalkyl titanate and a complexing agent; said oligomer comprises repeat units derived from said carbonyl compound and said alcohol; and said complexing agent is a hydroxycarboxylic acid, an alkanolamine, an aminocarboxylic acid, or combinations of two or more thereof and said phosphorus-containing ester is
30 trimethyl phosphite; triethyl phosphite; tributyl phosphite; tri-isopropylphosphite; trisdodecyl phosphite; trinonyldecyl phosphite; triphenylphosphite; phosphorous acid, [1,1'-biphenyl]-4,4'-diylbis-, tetrakis(2,4-bis(1,1-dimethylethyl)phenyl)ester;

(tris-(2,4-di-t-butyl) phosphite; triethylene glycol phosphite; tripropylene glycol phosphite; tributylene glycol phosphite; or combinations of two or more thereof.

38. A process according to claim 37 wherein said complexing agent is lactic acid, glycolic acid, citric acid, isocitric acid, tartaric acid, malic acid,
5 malonic acid, glycine, hydroxyethyl glycine, bis-hydroxyethyl glycine, or combinations of two or more thereof.

39. A process according to claim 38 wherein said complexing agent is lactic acid.

40. A process according to claim 37 wherein said tetraalkyl titanate is
10 tetra isopropyl titanate, tetra n-butyl titanate, or combinations thereof.

41. A process according to claim 39 wherein said tetraalkyl titanate is tetra isopropyl titanate, tetra n-butyl titanate, or combinations thereof.

42. A process according to claim 36 wherein said catalyst further comprising a hypophosphorous acid, its salt, or both.

15 43. A process according to claim 38 wherein said catalyst further comprising a hypophosphorous acid, its salt, or both.

44. A process according to claim 41 wherein said hypophosphorous acid, its salt, or both is sodium hypophosphite.

45. A process according to claim 41 wherein said titanium compound
20 is TYZOR[®]LA (titanium bis ammonium lactate).

46. A process according to claim 37 further comprising a co-catalyst, which is aluminum, cobalt, zirconium, zinc, a compound comprising one or more of these metals, or combinations of two or more thereof.

47. A process according to claim 45 further comprising a co-catalyst,
25 which is zinc acetate, zinc chloride, zinc nitrate, zinc sulfate, or combinations of two or more thereof.

48. A process according to claim 47 wherein each of said catalyst and said co-catalyst is in a solution in which water or ethylene glycol is solvent.

49. A process according to claim 48 wherein said carbonyl compound
30 is terephthalic acid or ester thereof and said alcohol is ethylene glycol.

50. A process according to claim 49 wherein said stabilizer is tributyl phosphite; phosphorous acid, [1,1'-biphenyl]-4,4'-diylbis-,tetrakis(2,4-bis(1,1-dimethylethyl)phenyl)ester; triethylene glycol phosphite; or combinations of two or more thereof.